

Linzer biol. Beitr.	42/1	833-841	30.7.2010
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## **A contribution to the knowledge of robber flies (Diptera: Asilidae) from Semnan province, Iran**

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**A b s t r a c t :** Robber flies (Diptera: Asilidae) are powerful predators which have efficient role in biological control in almost ecosystems. The fauna of these beneficial insects was studied in Semnan province in northern Iran. Totally 20 species of 17 genera were collected from the mentioned region. In addition to the asilid species from Semnan province, distributional data and prey records are given too.

**K e y w o r d s :** Diptera, Asilidae, Fauna, Semnan province, Iran.

### **Introduction**

Robber flies (Diptera: Asilidae) comprise a large and widespread family of insects. The adults are often active flies of considerable size and readily attract attention (GELLER-GRIMM 2005). Asilid adults attack insects of almost all orders, from wasps, bees, and flies to dragonflies and grasshoppers; even some spiders are eaten (LAVIGNE et al. 1978; LAVIGNE 2003). Because they prey voraciously on other insects, they contribute to the maintenance of the natural balance among insect populations. We can often see them carrying a prey of surprising size. Robber flies are, compared to rest of the world of insects, monstrous and insatiable predators. They are well adjusted to this way of life. Their legs are strong and they can grasp the prey while flying. Their body is covered by thick bristles and hairs, which often protect them from the victims efforts to defend itself. The proboscis, with a sword-like hypopharynx (lower part of pharynx) of many kinds is able to pierce the thick body covering of even the hardest Coleopterans (SHUROVNEKOV 1962; JOERN & RUDD 1982; GELLER GRIMM 2005). Often we can see that these perches are very solid, i.e., stones, branches or tree trunks, onto which they always return and where several individuals usually gather. Some kinds specialize on butterflies (Lepidoptera) or beetles, (Coleoptera) or Ichneumonidae and stinging hymenopterans, but no monophagous or oligophagous species are known. It is interesting, that among the asilids themselves, we can observe the similar kind of cannibalism for which mantids or spiders are noted, wherein the female attacks the male during copulation. But it only occurs under exceptional circumstances (LAVIGNE 2003; GHAHARI et al. 2007c). In fact, robber flies can be regarded as a beneficial group of insects. However, it was also noted that they are enemies of honey bees and are commonly found around bee hives destroying large numbers. Some species, especially the smaller ones, do not catch their victims in flight, but await small insects which, by chance, fly within their reach. At any rate we are

unaware of any robber fly which is not a predator (HULL 1962; THEODOR 1980; BOSÁK & HRADSKÝ 2001).

Semnan is one of the 30 provinces of Iran. It is in the north of the country, and its center is Semnan. The province of Semnan covers an area of 96,816 square kilometers and stretches along the Alborz mountain range and borders to Dasht-e Kavir desert in its southern parts. The province is divided into two parts: a mountainous region, and the plains at the foot of the mountains. The former offers a scope for recreational activities as well as being a source for minerals, whereas the latter encompasses some ancient cities of Iran as one of the capitals of the Parthian empire was located here. Neighbours are in the North Golestan, Mazandaran, at the West Tehran, Qom, at the South Isfahan and at the East Khorasan-e Razavi. The forest of this province lies in the central province of Semnan, near its border with Golestan Province. It is one of the oldest forests in Iran which is a remnant of the third geological age.

Asilidae is known to have 1.634 species at Palearctic region (GELLER GRIMM 2005). The fauna of Iranian Asilidae was studied very well basis of the co-project between H. Ghahari and P.A. Lehr through 2000-2004 and R. Hayat. In a total of 8 papers were published on this taxon from Iran so far (OLDROYD 1958; ABBASSIAN-LINTZEN 1964a, b; LEHR et al. 2007; GHAHARI et al. 2007a, b; HAYAT et al. 2008; SAGHAEI et al. 2009).

## Materials and Methods

For studying the asilids' fauna of Semnan province, many samplings were conducted at different localities of this province. Additionally, many materials of different insect collections including, Damghan Islamic Azad University, Tehran Science & Research Branch and Semnan Agricultural and Natural Resources Institute were studied. Identifications made by ENGEL (1930), OLDROYD (1958), ABBASIAN-LINTZEN (1964a, b), TSACAS (1968), THEODOR (1980) and LEHR (1988). The taxonomic arrangement and distributional data for regions outside Iran are those of LEHR (1988, 1996), BOSÁK & HRADSKÝ (2001) and GELLER-GRIMM (2005).

## Results

Totally 20 asilid species from 17 genera were collected from different regions of Semnan province. The list of species with distributional data and preys record are given below.

### Family Asilidae

#### *Aneomochtherus perplexus* (BECKER 1923)

Material: Semnan province: Semnan, 2♀, 1♂, Unknown date.

Distribution outside Iran: Armenia, Russia.

***Asilus crabroniformis* LINNAEUS 1758**

M a t e r i a l : Semnan province: Unknown location, 1♂, Summer 2004.

D i s t r i b u t i o n o u t s i d e I r a n : Europe, Algeria, Caucasus, Chine, Morocco, Russia.

***Choerades fimbriata* (MEIGEN 1820)**

M a t e r i a l : Semnan province: Cheshmeh Ali, 2♂♂, 2♀♀, Unknown date.

D i s t r i b u t i o n o u t s i d e I r a n : Albania, Armenia, Austria, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Italy, Poland, Romania, Russia (Caucasus, Siberia), Spain, Switzerland, former Yugoslavia.

***Erebunus farinosus* (BECKER IN BECKER & STEIN 1913)**

M a t e r i a l : Semnan province: Semnan, 2♂♂, 1♀, July 2003.

P r e y r e c o r d : *Ectemnius rubicola* (Dufour & Perris) (Hymenoptera: Sphecidae).

D i s t r i b u t i o n o u t s i d e I r a n : Kazakhstan.

***Eutolmus parricida* (LOEW 1848)**

M a t e r i a l : Semnan province: Shahrood, 2♀♀, October 2001.

D i s t r i b u t i o n o u t s i d e I r a n : Afghanistan, Turkey.

***Hoplotrichis pallasii* (WIEDEMANN 1828)**

M a t e r i a l : Semnan province: Shahrood, 2♂♂, 3♀♀, July 2003.

P r e y r e c o r d : *Vespula rufa* (L.) and *V. vulgaris* (L.) (Hymenoptera: Vespidae).

D i s t r i b u t i o n o u t s i d e I r a n : Greece, Romania, Russia (South European territory, Kazakh), Turkey.

***Leptogaster pubicornis* LOEW 1847**

M a t e r i a l : Semnan province: Shahmirzad, 1♂, June 2006.

D i s t r i b u t i o n o u t s i d e I r a n : Bulgaria, Czech Republic, France, Germany, Greece, Hungary, Italy, Russia, Switzerland, Turkey.

***Machimus cyanopus* (LOEW 1849)**

M a t e r i a l : Semnan province: Shahmirzad, 2♂♂, 3♀♀, September 2003.

P r e y r e c o r d : *Lindenius albilabris* (F.) and *Achysphex pompiliformis* (Panzer) (Hymenoptera: Sphecidae).

D i s t r i b u t i o n o u t s i d e I r a n : Austria, Albania, Bulgaria, France, Germany, Greece, Hungary, Italy, Romania, Switzerland, Turkey, former Yugoslavia.

***Machiremisca decipiens* (WIEDEMANN IN MEIGEN 1820)**

Material: Semnan province: Semnan, 1♀, Unknown date.

Distribution outside Iran: France, Italy, Portugal, Spain.

***Molobratia egregia* (LOEW 1869)**

Material: Semnan province: Semnan, 1♀, October 2002.

Distribution outside Iran: Romania, Russia (Transcaucasus), Turkey.

***Pegesimallus volcatus* (WALKER 1849)**

Material: Semnan province: Semnan, 1♂, 2♀, August 2003.

Distribution outside Iran: China, India, Indonesia, Myanmar, Pakistan.

***Promachus canus leontochlaenus* LOEW 1871**

Material: Semnan province: Mahdishahr, 1♀, Unknown date.

Distribution outside Iran: Kazakhstan, Turkey.

***Promachus mustela* LOEW 1854**

Material: Semnan province: Shahrood, 2♂♂, October 2003.

Distribution outside Iran: Israel, Lebanon, Palestine, Syria, Turkey.

***Saropogon vestitus* (WIEDEMANN 1828)**

Material: Semnan province: Damghan, 2♂♂, 1♀, May 2003.

Prey record: *Strongylogaster xanthocera* (STEPHENS) (Hymenoptera: Tenthredinidae).

Distribution outside Iran: Egypt, Israel, Libya, Switzerland, Syria, Turkey.

***Satanas gigas* (EVERSMANN 1855)**

Material: Semnan province: Shahrood, 2♀♀, June 2005.

Distribution outside Iran: Algeria, Azerbaijan, China, Egypt, Greece, Israel, Kazakhstan, Libya, Mongolia, Romania, Russia, Turkey.

***Scytomedes haemorrhoidalis* (FABRICIUS 1794)**

Material: Semnan province: Unknown location, 1♀, Summer 2003.

Distribution outside Iran: Algeria, Bulgaria, France, Greece, Morocco, Tunisia.

***Stenopogon elongatus* (MEIGEN 1804)**

M a t e r i a l : Semnan province: Damghan, 1♂, Spring 2003.

D i s t r i b u t i o n o u t s i d e I r a n : Egypt, France, Greece, Hungary, Israel, Romania, Russia, Tunisia, Turkey, West Sahara.

***Stenopogon theodori* LEHR 1984**

M a t e r i a l : Semnan province: Damghan, 1♂, Spring 2003.

D i s t r i b u t i o n o u t s i d e I r a n : Jordan, Israel, Palestine, Mediterranean regions.

***Stichopogon scalaris* LOEW 1847**

M a t e r i a l : Semnan province: Cheshmeh Ali, 3♀♀, September 2004.

D i s t r i b u t i o n o u t s i d e I r a n : Bulgaria, Czech Republic, Egypt, France, Greece, Italy, Kazakhstan, Romania, Slovakia, Turkey.

***Stichopogon schineri* KOCH 1872**

M a t e r i a l : Semnan province: Cheshmeh Ali, 2♂♂, September 2004.

P r e y r e c o r d : *Nematus* (*Pteronidea*) *caeruleocarpus* (HARTIG) (Hymenoptera: Tenthredinidae).

D i s t r i b u t i o n o u t s i d e I r a n : Bulgaria, Germany, Spain, France, Corse, Greece, Italy, Yugoslavia (incl. Bosnia-Herzegovina, Croatia, Macedonia, Slovenia), Morocco and Switzerland.

## Discussion

The Asilidae are a worldwide family of insects known for their predatory habits and mimicry of other insects, especially some bees (Hymenoptera). Adults of many species are large and conspicuous, and they are easily recognized and frequently collected. Many species prey upon honey bees, sometimes causing significant damage to bee colonies (LEHR 1964; DENNIS & LAVIGNE 2007). Upon seizing its prey, the fly kills it with paralyzing saliva injected through its hypopharynx. The liquefied contents of the victim are then sucked up through the proboscis. Certain robber fly species seem to prefer bumblebees, wasps, dragonflies, grasshoppers, or beetles. The larval stage is spent in the soil, among plant roots, or in decaying stumps and logs, usually within the galleries of wood-boring insects. Asilid larvae are predators or ectoparasites that feed on eggs, larvae, or pupae of other insects. Larvae of most species that have been reared feed on white grubs (Coleoptera: Scarabaeidae), but some have been known to prey on larvae of other beetle families, Hymenoptera, Diptera, or Orthoptera eggs (KNUTSON 1972; LAVIGNE et al. 1978; WOOD 1981; FOOTE 1991). Their specialized habitats and other species-specific specializations, together with their ecological roles as primary predators among the insects, make robber flies significant elements of the ecosystem. Along with butterflies (Lepidoptera), tiger beetles (Coleoptera: Carabidae), and dragonflies (Odonata), robber flies are increasingly viewed as a focal group of conservation concern.

Due to the dependence of some species on much-reduced habitat types, such as prairies, there is concern that several species may have experienced population declines. In general, grasslands support a highly diverse robber fly fauna, and perhaps the most serious historic anthropogenic stress on robber fly populations has been the destruction of grasslands by farming, overgrazing, fire suppression, vehicular traffic, and introduction of weeds. Forest species may be adversely affected by logging operations, especially those that remove woody debris used as breeding sites by asilid larvae (BARNES et al. 2007). Some robber flies are regarded as potential biological control agents against scarab larvae (WEI et al. 1995).

The fauna of Iranian Asilidae was studied rather well especially upon the established project between H. Ghahari and deceased P.A. Lehr of Russia in 2001. After death of Lehr in 2005, two other authorized taxonomists, R. Hayat of Turkey and R.J. Lavigne of Australia cooperated with H. Ghahari for progress of the project and preparing some publications (e.g. LEHR et al. 2007; GHAHARI et al. 2007a, b, c; HAYAT et al. 2008). However, Iran is a large country and therefore several new records and perhaps new species are expected to be discovered in this region of Palaearctic. Continuing the surveys on robber flies in other provinces of Iran is necessary for completing the fauna of Iran. Another important and interesting project can be the determining of asilids' preys in Iran. These predators have several preys from the various taxa (LAVIGNE 2003; GELLER-GRIMM 2005; LOND T 2006; DENNIS & LAVIGNE 2007).

Since Dr. P.A. Lehr had very important role in determining of several asilid's specimens and also completing the fauna of Iranian robber flies, his biography is given below.

#### **Pavel Andreyevich Lehr (27 September 1923 - 15 September 2005)**

Pavel Andreyevich Lehr was one of the most skilful taxonomists on Palaearctic Asilidae. In 1953 Lehr graduated, cum laude, from Kazakh State University in Alma-Ata and subsequently taught high school with his wife Nina in North Kazakhstan. From 1956 to 1965 he headed the Laboratory of Biological Control in the Institute of Plant Protection in Alma-Ata and from 1965 to 1973 he was a teacher and later professor of Kazakh State University. In 1973 he was made head of the Laboratory of Systematics and Zoogeography of Terrestrial Arthropods in the Institute of Biology and Soil Science, Vladivostok. From 1977 to 1979 he was Deputy Director of this Institute and from 1981 to 1991 he was Director. From 1991 until his death he was a consultant to the Russian Academy of Sciences. Lehr's Ph.D. dissertation, "Asilid flies of South-East Kazakhstan", was defended in 1959; an additional doctoral dissertation, "Asilid flies of Kazakhstan and Middle Asia" was completed and defended in 1970. In 1987 he was elected a corresponding member of the Academy of Sciences. In 1973 Lehr founded the Laboratory of Systematics and Zoogeography of Terrestrial Arthropods (later called the Laboratory of Entomology) in the Institute of Biology and Soil Science, Vladivostok. It was his idea to create the fundamental publication, "Key to the Insects of the Russian Far East" which deals with all the insects of the Russian Far East and adjacent territories. This long-term project (19 parts in 6 volumes) began in 1986; 16 parts treating more than 23,000 insect species have already been published. Dr. Lehr was a world authority on robber flies (Diptera: Asilidae), and investigated vast territories of the Russian Far East, Siberia, Kazakhstan, Middle Asia and Iran. He described one subfamily, four tribes, 34 genera and 292 species and subspecies, mainly from the Palaearctic region. His asilid collection housed in the Institute of Biology and Soil Science, Vladivostok, numbers 40,000 speci-

mens of 700 species, including the holotypes of 117 species and paratypes of 57 species. His sections on the Asilidae in the Catalogue of Palaearctic Diptera (1988) and the monograph "Robber flies of the subfamily Asilinae (Diptera, Asilidae) of the Palaearctic Region" (1996) are among the most important of his 91 scientific contributions. Dr. Lehr (1996-2002) was making further important inroads into Far eastern asilid taxonomy. All his papers between 1996-2006 were listed in the bibliography of Asilidae (Ghahari et al. 2007c). His last papers were published in 2007 (Lehr et al. 2007; Ghahari et al. 2007b), 2 years after his death and upon the determined specimens by him. Dr. Lehr supported many young researchers - nine Ph.D. dissertations have been defended under his guidance and some of his students now hold prominent positions in Russian entomology. His colleagues have named two genera and 21 species after him. Dr. Pavel Andreyevich Lehr is buried in Sergiev Posad, near Moscow. Peace is to his departed spirit.

### Acknowledgments

The authors are grateful to Dr. R. Hayat of Turkey for valuable helps in progress of the project. The research was supported by Islamic Azad University, Ghaemshahr and Tehran Science and Research Branch.

### Zusammenfassung

Raubfliegen spielen als Räuber eine wichtige Rolle im biologischen Gleichgewicht der meisten Ökosysteme. Die Fauna dieser Fliegenfamilie war Gegenstand einer Studie in der Provinz Semnan im Norden Irans. Insgesamt wurden im Untersuchungsgebiet 20 Arten aus 17 Gattungen nachgewiesen, Angaben zu Beutetieren und zur Verbreitung vervollständigen die vorliegende Arbeit.

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